

FILE 'USPAT' ENTERED AT 15:49:08 ON 31 JAN 1998

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* W E L C O M E T O T H E *
* U. S. P A T E N T T E X T F I L E *
* *

=> s epoxidation or epoxidize or epoxidise

3329 EPOXIDATION
277 EPOXIDIZE
24 EPOXIDISE
L1 3392 EPOXIDATION OR EPOXIDIZE OR EPOXIDISE

=> s rubber#

L2 254841 RUBBER#

=> s l1(w)ratio#

555272 RATIO#
L3 3 L1(W)RATIO#

=> d 13 cit 1-3

1. 4,581,152, Apr. 8, 1986, Water-soluble coolant for formation of drawn and ironed cans; Hisashi Hotta, et al., 252/78.5; 508/224; 558/105; 987/224 [IMAGE AVAILABLE]

2. 4,010,195, Mar. 1, 1977, Process for producing methyl p-toluate; Nobuo Isogai, et al., 423/587; 549/525; 560/103; 562/496; 568/866 [IMAGE AVAILABLE]

3. 3,981,909, Sep. 21, 1976, Process for producing per-p-toluic acid and utilizing the same; Nobuo Isogai, et al., 562/5; 549/525; 560/103; 562/493 [IMAGE AVAILABLE]

=> s l1(p)l2

L4 68 L1(P)L2

=> s natural rubber#

244080 NATURAL
254841 RUBBER#
L5 16287 NATURAL RUBBER#
(NATURAL(W) RUBBER#)

=> s l4(l)l5

L6 19 L4(L)L5

=> d 16 cit 1-19

1. 5,633,433, May 27, 1997, Rubber particle protein gene from guayule; Ralph A. Backhaus, et al., 800/205; 435/172.3, 320.1; 536/23.6; 800/DIG.9 [IMAGE AVAILABLE]

- , 2. 5,622,998, Apr. 22, 1997, Depolymerized natural rubber and process for preparation thereof; Yasuyuki Tanaka, et al., 521/41; 524/575.5; 526/340.2; 528/490 [IMAGE AVAILABLE]
3. 5,569,690, Oct. 29, 1996, Rubber composition for tire; Katsumi Terakawa, et al., 524/251, 252, 495, 496 [IMAGE AVAILABLE]
4. 5,475,051, Dec. 12, 1995, Halobutyl/epoxidized rubber matrices reinforced with siliceous filler materials; Jean Machurat, 524/519, 442, 447, 492, 493, 494, 495, 496; 525/343, 352, 359.1 [IMAGE AVAILABLE]
5. 5,447,976, Sep. 5, 1995, Rubber composition containing blends of natural rubber and epoxidized natural rubber; Patrick J. Curtin, et al., 523/438, 437; 525/122, 194 [IMAGE AVAILABLE]
6. 5,310,819, May 10, 1994, Surface epoxidation of elastomers; Charles M. Roland, et al., 525/385; 524/245 [IMAGE AVAILABLE]
7. 5,246,735, Sep. 21, 1993, Process for producing rubber-reinforcing aromatic polyamide multifilament yarn; Tadahiko Takata, et al., 427/175; 57/251, 902; 152/451; 156/315, 910; 427/385.5, 386; 428/383, 395 [IMAGE AVAILABLE]
8. 5,202,384, Apr. 13, 1993, Polyester reinforced rubber; James B. Pyle, et al., 525/167, 173, 174, 175, 177, 437 [IMAGE AVAILABLE]
9. 5,157,079, Oct. 20, 1992, Epoxidized natural rubber with epoxy resin and trialkoxysilyl group-containing polyamine or polymercaptan; Edward W. Duck, et al., 525/113, 107, 122 [IMAGE AVAILABLE]
10. 5,118,546, Jun. 2, 1992, Blend of polychloroprene and epoxidized natural rubber; Donald J. Burlett, et al., 428/36.8; 152/151, 525; 525/215 [IMAGE AVAILABLE]
11. 5,034,470, Jul. 23, 1991, Process for the preparation of epoxidized synthetic cis-1,4-polyisoprene; Joseph F. Geiser, et al., 525/360, 332.8, 332.9, 333.1, 333.2, 387 [IMAGE AVAILABLE]
12. 4,996,262, Feb. 26, 1991, Polyester reinforced rubber; James B. Pyke, et al., 525/177, 64, 167, 173, 174, 175 [IMAGE AVAILABLE]
13. 4,992,513, Feb. 12, 1991, High modulus rubber composition; Richard G. Bauer, et al., 525/184, 182 [IMAGE AVAILABLE]
14. 4,968,749, Nov. 6, 1990, Polyphenylene ether-polyamide resin composition; Nobuhiro Shibuya, et al., 525/92D, 66, 68, 134, 181, 392, 395, 396, 397 [IMAGE AVAILABLE]
15. 4,829,124, May 9, 1989, Dynamically crosslinked thermoplastic elastomer; Lawrence Clark, 525/108, 116, 119, 186, 193 [IMAGE AVAILABLE]
16. 4,829,115, May 9, 1989, Organothioethyl alcohol segmers as antidegradant synergists; Kirkwood S. Cottman, 524/255; 252/401, 404, 406; 508/570; 524/289, 291, 302, 304, 305, 310, 350, 381; 525/347; 554/101; 560/9, 152, 154 [IMAGE AVAILABLE]
17. 4,595,632, Jun. 17, 1986, Fluorocarbon grafting of polymeric substrates; Kenneth G. Mayhan, et al., 428/409, 421, 422, 492, 521, 694BF, 694TF; 525/126, 333.2, 355, 383 [IMAGE AVAILABLE]
18. 4,528,340, Jul. 9, 1985, Process for producing hydrophilic polymers; Osamu Hayashi, et al., 525/379, 329.3, 331.7, 332.8, 332.9, 333.1, 333.2, 381, 382, 386, 387 [IMAGE AVAILABLE]

19. 4,341,672, Jul. 27, 1982, Sulfur or peroxy cured epoxidized diene
rubbers; Henry L. Hsieh, et al., 523/451, 400, 456, 457; 525/332.6,

=> d 16 ab 10,11,13,18,19

US PAT NO: 5,118,546 :IMAGE AVAILABLE:

L6: 10 of 19

ABSTRACT:

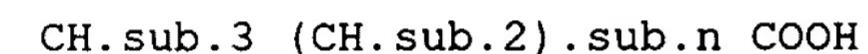
The present invention relates to an elastomeric composition comprising a blend of from about 25 to about 75 percent by weight of polychloroprene and from about 75 to about 25 percent by weight of epoxidized natural rubber having a level of epoxide modification in the range of from about 15 to 85 mole percent. These blends may be incorporated along with conventional sulfur-vulcanized elastomers to provide new and improved compounded rubbers particularly suited for use in tire tread applications.

US PAT NO: 5,034,470 :IMAGE AVAILABLE:

L6: 11 of 19

ABSTRACT:

The present invention relates to a process for the preparation of epoxidized synthetic cis-1,4-polyisoprene. The process involves reacting the synthetic cis-1,4-polyisoprene in a C_{sub.5}-C_{sub.7} aliphatic hydrocarbon with tertiary butyl hydroperoxide in the presence of a molybdenum catalyst at a reaction temperature ranging from about 20.degree. C. to about 100.degree. C. The molybdenum catalyst is prepared by reacting together under a N_{sub.2} atmosphere molybdenum pentachloride with a carboxylic acid of the formula:



wherein n is an integer ranging from 8 to 28. The molar ratio of molybdenum pentachloride to the carboxylic acid ranges from about 1:1 to 1:3.

US PAT NO: 4,992,513 :IMAGE AVAILABLE:

L6: 13 of 19

ABSTRACT:

It is desirable to increase the modulus of rubbers utilized in a wide variety of applications. This invention discloses a technique for modifying rubbers to improve their modulus without sacrificing other properties. The subject invention more specifically relates to a process for preparing a rubber composition having a high modulus which comprises reacting at least one epoxidized rubber with from about 2 phr to about 55 phr of at least one nylon at a temperature which is within the range of about 140.degree. C. to about 300.degree. C.

US PAT NO: 4,528,340 :IMAGE AVAILABLE:

L6: 18 of 19

ABSTRACT:

A hydrophilic modified diene polymer material is produced by the steps of epoxidizing a diene polymer material consisting of at least one member selected from rubber polymers which have a molecular weight of 10,000 or more and contain an 85 molar % of more 1,4-addition structure based on the entire molar amount of double bonds contained therein, and crystalline 1,2-polybutadiene polymers which have a melting point of from 60.degree. C. to 170.degree. C., and a reduced viscosity (nsp/c) of 0.2 or more determined in a tetrahydronaphthalene solution in a concentration of 200 mg/100 ml at a temperature of 100.degree. C., and contain a 75 molar % or more 1,2-addition structure based on the entire molar amount of double bonds contained therein, for example, with a combination of a carboxylic acid and a peroxide compound, or a carboxylic peracid, to an extent such that the degree of epoxidization of the rubber polymers is in

the range of from 5% to 60% and the degree of epoxidization of the crystalline 1,2-polybutadiene is in the range of from 5% to 45%; and ring-opening at least a portion of the epoxy rings in the resultant epoxidized polymeric material by heating it in the presence of a tertiary amine and a carboxylic acid.

US PAT NO: 4,341,672 :IMAGE AVAILABLE:

L6: 19 of 19

ABSTRACT:

Sulfur or peroxy cured compositions prepared from epoxidized diene r

=> d 16 kwic 18

US PAT NO: 4,528,340 :IMAGE AVAILABLE:

L6: 18 of 19

SUMMARY:

BSUM(17)

The . . . unsaturated double bonds and a high molecular weight. As a result, the inventors of the present invention discovered that when **rubber** polymers, for example, 1,4-polybutadiene, or crystalline 1,2-polybutadienes having a high molecular weight are subjected to epoxidization so as to **epoxidize** the unsaturated double bonds contained therein to a specific degree of epoxidization and the resultant epoxidized products are heated in. . . .

SUMMARY:

BSUM(25)

The rubber polymers usable for the present invention are preferably selected from the group consisting of **natural rubber** and synthetic rubber polymers, for example, 1,4-polybutadiene polymers, polyisoprene polymers, styrene-butadiene copolymers, and acrylonitrilebutadiene copolymers. Usually, the **natural rubber** consists essentially of polyisoprene having a high molecular weight and containing a 98 molar % or more 1,4-addition structure.

SUMMARY:

BSUM(47)

The . . . to 90.degree. C., more preferably, from 20.degree. C. to 60.degree. C., for 10 minutes to 10 hours, so as to **epoxidize** the diene polymer material to an extent such that the degree of epoxidization of the **rubber** polymer is in the range of from 5 to 60 molar %, preferably, from 15 to 45 molar %, and . . . 45 molar %, preferably, 10 to 35 molar %, based on the entire molar amounts of double bonds in the **rubber** polymer and the crystalline 1,2-polybutadiene polymer,
r

=> d 16 kwic 19

US PAT NO: 4,341,672 :IMAGE AVAILABLE:

L6: 19 of 19

SUMMARY:

BSUM(4)

Rubbers which have been used in the manufacture of such as tire tread compositions include **natural rubber** and various synthetic polymers such as polyisoprene, butyl rubber, polybutadiene, styrene/butadiene copolymers, ethylene/propylene/diene terpolymers, and others, alone or in various. . .

SUMMARY:

BSUM(9)

Our . . . a broad usage of the term to include any rubber whose structure is based on a conjugated diene, whether a **natural rubber**, or a synthetic rubber prepared by such as the well known emulsion or solution processes.

SUMMARY:

BSUM(11)

Of the various synthetic diene **rubbers**, presently preferred are the solution-polymerized diene **rubbers** because of their compositional uniformity, ease of preparation, ease of fabrication, ease of preparation of copolymers or polymers with molecular weight ranges particularly suitable for the **epoxidation** step in accordance with our invention to extents beneficial to wet skid resistance.

SUMMARY:

BSUM(13)

Presently preferred are **rubbery** diene polymers exhibiting, before curing, molecular weights in the range of about 50,000 to 500,000, preferably about 75,000 to 300,000 for ease of handling, including during the **epoxidation** stage and subsequent processing and fabrication.

SUMMARY:

BSUM(14)

Aside from the **natural rubber** which we include as a "diene rubber", the diene rubbers can be prepared from polymerizable conjugated dienes, generally those in. . .

SUMMARY:

BSUM(19)

The . . . polymerization, and the like. As mentioned hereinabove, particularly preferred for convenience of handling and ease of handling in the subsequent **epoxidation** step are solution polymerization procedures employing the hydrocarbyl alkali metal initiator such as the

hydrocarbyllithium initiators which presently are most commercially preferred. These lithium initiators, such as n-butyllithium, are well known in the art. Where a **rubbery** random copolymer is desired, various types of randomizing agents such as tetrahydrofuran, or potassium t-amyloxide can be employed. Modification of. . .

SUMMARY:

BSUM(20)

The **rubbery** diene polymer, prior to compounding and curing, in accordance with our invention is epoxidized. **Epoxidation** can be effected by the use of epoxidizing agents such as a peracid such as m-chloroperbenzoic acid, peracetic acid, or. . .

SUMMARY:

BSUM(21)

Epoxidation is conducted employing a solvent capable of substantially dissolving the diene **rubbers** in their original condition as well as after being epoxidized. Suitable solvents are generally aromatic solvents such as benzene, toluene,. . .

SUMMARY:

BSUM(24)

Presently recommended is an extent of **epoxidation**, defined as the percentage of originally present olefinically unsaturated sites in the diene **rubber** which has been converted to oxirane, hydroxyl, and ester groups, about 5 to 95 percent, presently preferred about 10 to. . .

SUMMARY:

BSUM(25)

Subsequent to **epoxidation**, the now epoxidized diene **rubber** can be isolated by removal of the acidic catalyst through filtration, or by adding dilute aqueous base to neutralize soluble. . .

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L3 3 S L1(W)RATIO#
L4 68 S L1(P)L2
L5 16287 S NATURAL RUBBER#
L6 19 S L4(L)L5